CLAIMS

What is claimed is:

1. A method of treating an inner ear disorder in a subject, the disorder being caused by aberrant glutamate-mediated neurotransmission, the method comprising the steps of:

administering to a subject suffering from an inner ear disorder, a formulation comprising an agent that modulates glutamate-mediated neurotransmission or sodium channel function, thereby treating the inner ear disorder in the subject.

2. The method claim 1, wherein the formulation is administered to the round window membrane of the subject, and wherein delivery of the agent to the round window membrane results in passage of the agent through the round window membrane and into the inner ear of the subject to provide modulation of glutamate-mediated neurotransmission and treatment of the inner ear disorder in the subject.

3. The method of claim 1, wherein the agent inhibits pre-synaptic release of glutamate.

4. The method of claim 1, wherein the agent inhibits glutamate-mediated neurotransmission post-synaptically.

5. The method of claim 1, wherein the agent is a glutamate ionotropic receptor antagonist.

6. The method of claim 5, wherein the glutamate ionotropic receptor antagonist is an NMDA receptor antagonist.

7. The method of claim 6, wherein the NMDA receptor antagonist is selected from the group consisting of: D-AP5, MK 801, 7-chlorokynurenate, gacyclidine, and derivatives or analogues thereof.

8. The method of claim 1, wherein the formulation is administered using an implanted drug delivery device.

9. The method of claim 1, wherein the formulation is administered by injection into the middle ear so as to bring the formulation into contact with the round window membrane.

10. The method of claim 1, wherein the formulation is delivered from the formulation at a rate of from about 0.1 μg per hour to 200 μg per hour, continually, for a period of at least 24 hours.

11. The method of claim 1, wherein the agent is delivered from formulation to provide for treatment of the inner ear disorder for a period of at least about 3 days.

12. The method of claim 1, wherein the inner ear disorder is selected from the group consisting of: tinnitus, noise-induced trauma, age-induced degeneration and ischemic-induced trauma.

13. A pharmaceutical composition for treating an inner ear disorder comprising an NMDA receptor antagonist that modulates glutamate-mediated neurotransmission.

14. The pharmaceutical composition of claim 13, wherein the NMDA receptor antagonist is selected from the group consisting of: D-AP5, MK 801, 7-chlorokynurenate, gacyclidine, and derivatives or analogues thereof.

15. A system for delivery of a drug to the round window membrane of the inner ear wherein the system comprises a sustained-release drug delivery device and a drug, and wherein the drug modulates glutamate-mediated neurotransmission, and wherein the drug is delivered to the round window membrane over a period of at least 24 hours.

16. The system of claim 15 wherein the drug is an NMDA receptor antagonist.

17. The system of claim 16 wherein the drug is selected from the group consisting of:

D-AP5, MK 801, 7-chlorokynurenate, gacyclidine, and derivatives or analogues thereof.

18. The system of claim 15 wherein the drug delivery device comprises a pump

19. The system of claim 15 wherein the drug delivery device comprises a catheter.

20. The system of claim 19 wherein the drug is an NMDA receptor antagonist that modulates glutamate-mediated neurotransmission.

21. The system of claim 20 wherein the drug is selected from the group consisting of: D-AP5, MK 801, 7-chlorokynurenate, gacyclidine, and derivatives or analogues thereof.

AMENDED CLAIMS

[Received by the International Bureau on 7 August 2003 (07.08.03) ; original claims 1-21 replaced by new claims 1-18]

1. A pharmaceutical composition for treating an inner ear disorder, the composition comprising an agent that modulates glutamate-mediated neurotransmission or sodium channel function without causing significant clinical hearing loss associated with suppression of AMPA receptor-mediated signals.

2. The pharmaceutical composition of claim 1, wherein the agent inhibits pre-synaptic release of glutamate.

3. The pharmaceutical composition of claim 1, wherein the agent inhibits glutamate-mediated neurotransmission post-synaptically.

4. The pharmaceutical composition of claim 1, wherein the agent is a glutamate ionotropic receptor antagonist.

5. The pharmaceutical composition of claim 4, wherein the glutamate ionotropic receptor antagonist is an NMDA receptor antagonist.

6. The pharmaceutical composition of claim 5, wherein the NMDA receptor antagonist is selected from the group consisting of: D-AP5, MK 801, 7-chlorokynurenate, gacyclidine, and derivatives or analogues thereof.

7. A system for delivery of a drug to the round window membrane of the inner ear to treat an inner ear disorder, wherein the system comprises a sustained-release drug delivery device and a drug, and wherein the drug modulates glutamate-mediated neurotransmission without causing significant clinical hearing loss associated with suppression of AMPA receptor-mediated signals, and wherein the drug is delivered to the round window membrane over a period of at least 24 hours.

8. The system of claim 7 wherein the drug is an NMDA receptor antagonist.

9. The system of claim 8 wherein the NMDA receptor antagonist is selected from the group consisting of: D-AP5, MK 801, 7-chlorokynurenate, gacyclidine, and derivatives or analogues thereof.

10. The system of claim 8 wherein the drug delivery device comprises a pump

11. The system of claim 8 wherein the drug delivery device comprises a catheter.

12. The system of claim 8, wherein the drug is delivered at a rate of from about 0.1 μg per hour to 200 μg per hour for a period of at least 24 hours.

13. The system of claim 8, wherein the drug is delivered to the round window membrane of the inner ear for a period of at least about 3 days.

14. A method for treating an inner ear disorder in a subject, the disorder being caused by aberrant glutamate-mediated neurotransmission, the method comprising:

administering to a round window membrane of a subject suffering from an inner ear disorder, a formulation comprising an agent that modulates glutamate-mediated neurotransmission or sodium channel function, thereby treating the inner ear disorder in the subject,

wherein administration results in passage of the agent through the round window membrane and into the inner ear of the subject to provide modulation of glutamate-mediated neurotransmission without causing significant clinical hearing loss associated with suppression of AMPA receptor-mediated signals.

15. The method of claim 14, wherein the agent is an NMDA receptor antagonist.

16. The method of claim 15, wherein the NMDA receptor antagonist is selected from the group consisting of: D-AP5, MK 801, 7-chlorokynurenate, gacyclidine, and derivatives or analogues thereof.

17. The method of claim 14 wherein the agent is delivered to the round window membrane of the inner ear for a period of at least about 3 days.

18. The method of claim 14, wherein the agent is delivered at a rate of from about 0.1 μg per hour to 200 μg per hour, continually, for a period of at least 24 hours.